

about 50%, more preferably greater than 60% and most preferably greater than 90% of the unreacted compound.

[0032] The organic compound may be oxidized by contacting the organic compound with a catalyst system in a suitable organic solvent such as toluene, *tert*-amyl alcohol, ~~water~~, CHCl₃, methylene chloride, 1,2-dichloroethane, and benzene. Other suitable solvents for oxidation reactions are well known in the art.

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[0048] The oxidation of ethylene to acetaldehyde, commonly referred to as the Wacker oxidation reaction (Smidt et al., *Angew. Chem.* 71:176 (1959); Smidt et al., *Angew. Chem., Int. Ed. Engl.* 1:80 (1962); and Smidt, *J. Chem. Ind.* 54 (1962)), is one of the best-known reactions catalyzed by palladium(II). Typically, palladium is complexed with a copper co-oxidant to re-oxidize the palladium, such as PdCl₂-CuCl₂. This oxidation reaction is useful in the synthetic transformation of olefins, but there has been minimal work on catalyzed enantioselective Wacker-type cyclization reactions. See for example, Uozumi et al., *J. Org. Chem.* 63:5071-5075 (1998), where a ~~Pd-borax~~ Pd-borax catalyst was used in combination with benzoquinone as the co-oxidant.

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[0050] In one embodiment of the invention, the enantioselective oxidation reaction is an enantioselective aromatic oxidation reaction. This reaction typically involves the oxidation of a hydroxymethylphenol to a spiro epoxy-~~cyclohexadienone~~ cyclohexadienone. Scheme IV illustrates one such reaction. It is understood however, that other compounds that undergo this type of reaction can be used instead of compound IV.1. For example, the compound can have one or more substitutions on the aromatic ring or the compound may be a heteroaryl or other aryl ring.

[0053] In addition to the reactions illustrated above as Schemes I-X, the catalyst system of the invention finds utility in the improved synthesis of numerous pharmaceutical agents that have chiral centers. Such pharmaceutical agents can thus exist as a pair mixture of enantiomers. When chemically synthesized, the resulting product is often a racemic mixture ~~so the two~~